

CLAIMS

What is claimed is:

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A1 1. A spring element comprising a first elastic member and a conductive member, said first elastic member being comprised of a first elastomeric material having a first modulus of elasticity, said first elastic member having a portion of said first elastomeric material removed such that said spring element has an overall modulus of elasticity different from said first modulus of elasticity.

2. The spring element of claim 1, wherein said portion of said elastomeric material removed from said first elastic member forms a hole in said first elastic member.

A 3. The spring element of claim 1, wherein said first elastic member is o-ring shaped.

A 4. The spring element of claim 1, wherein said first elastic member has a plurality of holes formed therein.

5. The spring element of claim 4, further comprising a second elastic member comprised of a second elastomeric material having a second modulus of elasticity, said second elastic member positioned in at least one of said plurality of holes formed in said first elastic member such that said overall modulus of elasticity is different from said first and second moduli of elasticity.

6. The spring element of claim 5, further comprising a plurality of said second elastic members, said plurality of said second elastic members positioned in a plurality of said plurality of holes in said first elastic member.



7. The spring element of claim 1, wherein said portion of said first elastomeric material removed from said first elastic member forms at least one cavity in the first elastic member.

8. The spring element of claim 7, wherein said first elastic member has a plurality of cavities formed therein.

9. The spring element of claim 1, wherein said conductive member comprises a plurality of conductive particles.

10. The spring element of claim 9, wherein said plurality of conductive particles are interspersed within said first elastic member.

11. The spring element of claim 1, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

12. The spring element of claim 1, wherein said conductive member comprises a plurality of conductive threads.

13. The spring element of claim 12, wherein said plurality of conductive threads comprise a plurality of non-conductive threads having a conductive coating.

14. The spring element of claim 12, wherein said plurality of conductive threads form a covering around said first elastic member.

15. The spring element of claim 1, wherein said conductive member is comprised of conductive material selected from the group consisting of gold, aluminum, nickel, silver, stainless steel, and alloys thereof.



16. A spring element comprising a first elastic member, a second elastic member and a conductive member, said first elastic member being comprised of a first elastomeric material having a first modulus of elasticity, said second elastic member being comprised of a second elastomeric material having a second modulus of elasticity, said second elastic member positioned within said first elastic member such that said spring element has an overall modulus of elasticity different from said first and second moduli of elasticity.

17. The spring element of claim 16, further comprising a plurality of said second elastic members positioned within said first elastic member.

18. The spring element of claim 16, wherein said conductive member comprises a plurality of conductive particles.

19. The spring element of claim 16, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

20. The spring element of claim 16, wherein said conductive member comprises a plurality of conductive threads.



21. A spring element comprising a plurality of interwoven threads and a conductive member.

22. The spring element of claim 21, wherein said conductive member comprises a plurality of conductive particles.

23. The spring element of claim 21, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

24. The spring element of claim 21, wherein said conductive member comprises a plurality of conductive threads interwoven with said plurality of interwoven threads.

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25. A spring element comprising a conductive member and an elastic member having a variable spring constant.
26. The spring element of claim 25, wherein said conductive member comprises a plurality of conductive particles.
27. The spring element of claim 25, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.
28. The spring element of claim 25, wherein said conductive member comprises a plurality of conductive threads.

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29. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including an elastomeric member and a conductive member.

30. The apparatus of claim 29, wherein said conductive member comprises a plurality of conductive particles.

31. The apparatus of claim 29, wherein said plurality of conductive particles are interspersed within said first elastic member.

32. The apparatus of claim 29, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

33. The apparatus of claim 29, wherein said conductive member comprises a plurality of conductive threads.

34. The apparatus of claim 33, wherein said plurality of conductive threads comprise a plurality of non-conductive threads having a conductive coating.

35. The apparatus of claim 33, wherein said plurality of conductive threads form a covering around said first elastic member.



36. The apparatus of claim 29, wherein said conductive member is comprised of conductive material selected from the group consisting of gold, aluminum, nickel, silver stainless steel, and alloys thereof.

37. The apparatus of claim 29, wherein said semiconductor is electrically biased through said spring element.

38. The apparatus of claim 29, wherein said semiconductor comprises a semiconductor die.

39. The apparatus of claim 29, wherein said semiconductor comprises a semiconductor die formed within a semiconductor package.

40. The apparatus of claim 39, wherein said semiconductor package comprises a package selected from the group consisting of a chip-scale package, a ball grid array, a chip-on-board, a direct chip attach, and a flip-chip.

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41. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a cover and a spring element mechanically coupled to said cover, said spring element comprising an elastomeric member and a plurality of conductive threads forming a covering over said spring element.

42. The apparatus of claim 41, wherein said cover includes a first clamping member configured so that a first end portion of said spring element is force fit within said first clamping member.

43. The apparatus of claim 42, wherein said cover further includes a second clamping member configured so that a second end portion of said spring element is force fit within said second clamping member.



44. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a conductive member and a first elastic member comprised of a first elastomeric material having a first modulus of elasticity, said first elastic member having a plurality of holes formed therein such that said spring element has an overall modulus of elasticity different from said first modulus of elasticity.

45. The apparatus of claim 44, wherein said spring element further comprises an elastic member comprised of a second elastomeric material having a second modulus of elasticity, said second elastic member positioned in at least one of said plurality of holes formed in said first elastic member such that said overall modulus of elasticity is different from said first and second moduli of elasticity.

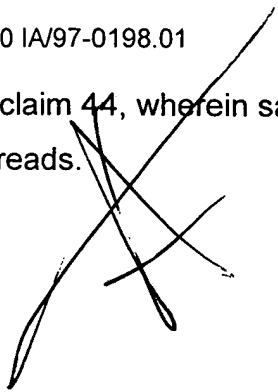
46. The apparatus of claim 44, wherein said spring element further comprises a plurality of second elastic members positioned in a plurality of said plurality of holes in said first elastic member.

47. The apparatus of claim 44, wherein said conductive member comprises a plurality of conductive particles.

48. The apparatus of claim 44, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

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49. The apparatus of claim 44, wherein said conductive member comprises a plurality of conductive threads.

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50. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including an elastic member comprised of a conductive member and an elastomeric material having a modulus of elasticity, said elastic member having a hole formed therein such that said spring element has an overall modulus of elasticity different from said modulus of elasticity of said elastomeric material, said elastic member being shaped so as to engage an outer edge of said semiconductor such that a force applied by said attachment device as said interconnect structure is pressed against said semiconductor is substantially uniform around said semiconductor.

51. The apparatus of claim 50, wherein said conductive member comprises a plurality of conductive particles.

52. The apparatus of claim 50, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

53. The apparatus of claim 50, wherein said conductive member comprises a plurality of conductive threads.

54. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a first conductive member, a first elastic member and a second elastic member, a first elastomeric material having a first modulus of elasticity and said second elastic member comprising a second elastomeric material having a second modulus of elasticity, said second elastic member being positioned within said first elastic member such that said spring element has an overall modulus of elasticity different from said first and second moduli of elasticity.

55. The apparatus of claim 54, further comprising a plurality of said second elastic members formed within said first elastic member.

56. The apparatus of claim 54, wherein said conductive member comprises a plurality of conductive particles.

57. The apparatus of claim 54, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

58. The apparatus of claim 54, wherein said conductive member comprises a plurality of conductive threads.



59. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts on said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element comprised of a plurality of interwoven threads and a conductive member.

60. The apparatus of claim 59, wherein said conductive member comprises a plurality of conductive particles.

61. The apparatus of claim 59, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

62. The apparatus of claim 59, wherein said conductive member comprises a plurality of conductive threads interwoven with said plurality of interwoven threads.



63. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a conductive member and an elastic member comprised of an elastomeric material having a modulus of elasticity, said elastic member having at least one cavity formed therein such that said spring element has an overall modulus of elasticity different from said modulus of elasticity of said elastomeric material.

64. The apparatus of claim 63, wherein said elastic member has a plurality of cavities formed therein.

65. The apparatus of claim 63, wherein said conductive member comprises a plurality of conductive particles.

66. The apparatus of claim 63, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

67. The apparatus of claim 63, wherein said conductive member comprises a plurality of conductive threads.



68. An apparatus for attaching to a plurality of contacts of a semiconductor, said apparatus comprising:

an interconnect structure comprising a plurality of conductors patterned to match corresponding ones of said plurality of contacts of said semiconductor; and

an attachment device pressing said interconnect structure against said semiconductor to provide an electrical connection between said plurality of conductors and said corresponding ones of said plurality of contacts, said attachment device comprising a spring element including a conductive member and an elastic member having a variable spring constant.

69. The apparatus of claim 68, wherein said conductive member comprises a plurality of conductive particles.

70. The apparatus of claim 68, wherein said conductive member comprises a layer of conductive material formed over said first elastic member.

71. The apparatus of claim 68, wherein said conductive member comprises a plurality of conductive threads.

72. The spring element of claim 1, wherein said conductive member comprises carbon.

73. The apparatus of claim 29, wherein said conductive member comprises carbon.